

Fish scales from the Permian of Western Australia

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(Communicated by M. H. Johnstone)

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Manuscript received 27 November 1979; accepted 18 March 1980

Abstract

Fish scales are recorded for the first time from the Permian of Western Australia. The scales, from the Byro Group in the Carnarvon Basin, are distinct from any Permian fish scales previously described from the Gondwanaland continents. The fish may have inhabited an open marine environment.

Introduction

Remains of fish are sporadic in the Permian deposits of the Gondwanaland continents. The present note documents the recent discovery of fish scales from the Coyrie Formation, Byro Group, of the Carnarvon Basin, Western Australia. These fish scales, collected during the recent mapping of the Carnarvon Basin by the Geological Survey of Western Australia (GSWA) (see Hocking *et al.* 1980 for revised stratigraphic nomenclature) are noteworthy because of their mode of occurrence, size and the environment of deposition.

Australian Permian fish

Few fish have been recorded from the Permian strata of Australia. The Sydney Basin (eastern Australia) has yielded the genus *Urosthene*s Dana (1848a, p.433; 1848b, p.149; 1849, p.171, Atlas Pl. 1 fig. 1-1a) with the type species *U. australis* Dana from the Newcastle Coal Measures and *U. latus* Woodward (1931) from the same strata. Woodward (1940) subsequently described a representative of *Elonichthys* from the same strata. The report by de Koninck (1877, p.354) of the bradyodont shark *Tomodus convexus* Agassiz? from New South Wales cannot be confirmed as the specimens were destroyed by fire (Teichert 1943, p.543-4). *Urosthene*s Dana lived in a non-marine habitat whereas de Koninck's bradyodont shark was probably of marine origin. Fossil fish remains have also been recorded from the Bowen Basin of Queensland by Dunstan (1901). The Queensland material included spines, vertebrae and scales; however, the specimens have apparently never been described or figured.

Records of fish in the Western Australian Permian Basins are restricted, to date, to several reports from the Carnarvon Basin. *Helicoprion* Karpinsky has been described from the Wandagee Formation (Woodward, 1886; Teichert, 1940) as well as representatives of bradyodont sharks (*Helodus* Agassiz and *Crassidonta* Branson) from the same formation (Teichert, 1943). The Wandagee Formation possesses a diverse invertebrate fauna, including articulate brachiopods, molluscs and crinoids, indicative

of an open marine environment. *Helicoprion* has also been recorded from the Bulgadoo Shale (Condon, 1967) a formation also with a diverse marine invertebrate fauna.

The new discovery

In addition to the fish scales, GSWA sample 44553 (Lat. 25°49'28" S, Long. 115°38'33"E, about 300 m south of Wooramel River, north-east of Darcy Hill; near top of Coyrie Formation) has yielded abundant, although invariably poorly preserved, specimens of *Fusispirifer byroensis* (Glauert 1912). Glauert's species is diagnostic of the Coyrie Formation and the Mallens Sandstone. Three specimens of *Fusispirifer byroensis* from sample 44553 have been registered in the GSWA collection with the numbers F11014, F11015, F11016. The age of these stratigraphic units is well controlled and is considered to be early Permian (Late Artinskian Stage, Early Baigendzinian Substage, Dickins 1976).

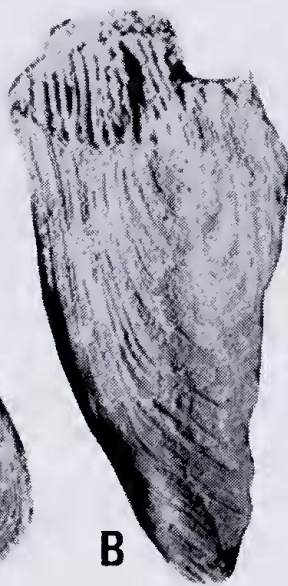
The discovery of fish scales from the same locality as abundant articulate brachiopods is of considerable interest because of the indubitably marine environment of deposition. The fish scales, described below, are large, ranging in length from 1 cm to 1.7 cm. The scales, well over one hundred specimens, are preserved in a single block of rock some 12 cm x 8 cm in size. The scales are thickly distributed, in random orientation throughout the block, with no indication of bedding or sedimentary structures. Such an aggregate of scales is suggestive of coprolitic accumulation, although no discrete coprolite shape was observable. Breaking the block revealed further scales throughout the entire specimen. The block is ferruginised with some original, though decomposed, material of the scales remaining with the impressions of the scales. If the block is coprolitic its size indicates a large predatory organism.

Affinities of the scales

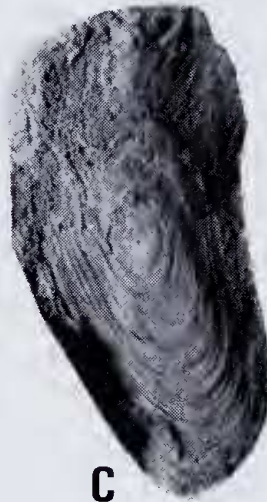
In an attempt to identify the scales a survey of Permian fish occurrences of the Gondwanaland continents was made. Few described fish scales were found to be similar, probably because of the inade-



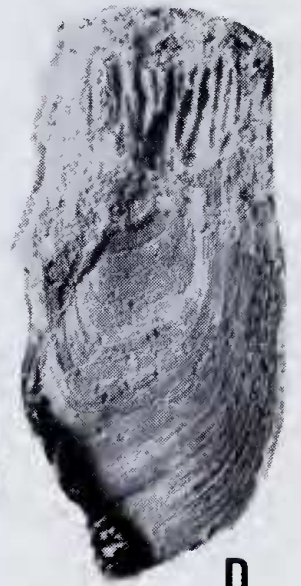
A



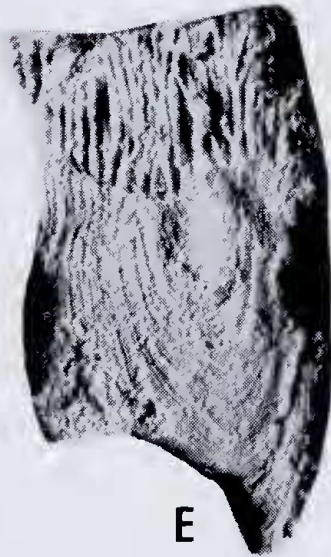
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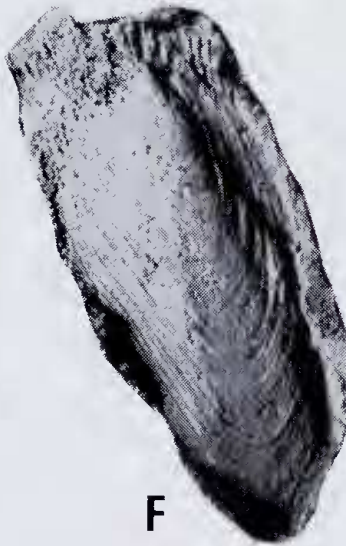
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F



G



H



I

quate documentation and illustrations of many reports. For the present, the nomenclature of the scales is left open, although it appears likely that the scales are of palaeoniscid affinity.

Permian fish scales have been recorded from Southern Africa, South America and India. However despite the substantial records the only fish scales from Southern Africa comparable to the present specimens from Western Australia, with respect to their apparent concentric ornament and strongly digitate hind margin, are the flank fish scales of *Acrolepis molyneuxi* figured by Woodward (1903, 1910). The South African fish scales are much smaller than the new Western Australian specimens.

The records of fish scales from the Late Palaeozoic of South America are plentiful, however, descriptions and illustrations are few. Fish scales described and figured by Martins (1948) are closely comparable with the new material especially in details of ornament and the digitate hind margin. Martins' specimens, from the Serie Marica, Rio Grande do Sol, are, however, smaller and possess a coarser concentric ornament than the Western Australian scales. Associated with the fish scales, Martins recorded an impoverished marine fauna of inarticulate brachiopods (*Lingula* and *Orbiculoidea*) indicative of marginal marine deposits.

Environment of the Western Australian scales

The determination of the environment of deposition of fossil fish is of critical importance and requires careful examination of stratigraphic evidence. Romer (1971, p.120) has commented on the uncertainty of habitat of many of the described forms, and on the problem of euryhaline species as well as those species with differences between early and late life stages. As noted above the Western Australian scales occur in sediments deposited in an open marine environment. Nevertheless caution about the habitat of the Western Australian fish is advisable, because of the inferred coprolite source of the specimens.

Systematic Palaeontology

Class PISCES

Incertae Sedis.

Description: The scales (Fig. 1) are of varying shape and outline, reflecting the varying position of the scales on the body of the fish. Length of the scales varies from 1 cm to 1.7 cm. The hind margin of the scales is digitate in an anastomosing pattern. The digitate portion of the scale is up to one quarter of the total length of the scale. The scales are thick (up to 0.5 mm) with one surface being smooth (the inner surface?), while the other surface possesses an ornament of sub-concentric lines and a micro-ornament of striae which increase in number anteriorly by intercalation. On worn impressions of scales this micro-ornament is lost.

Discussion: The thickness of the scales and the micro-ornament make these scales distinct from any record elsewhere from the Permian. The scales described by Martins (1948) discussed above are impressions that are possibly too worn (or the lithology may be too coarse) to preserve any micro-ornament. Close comparison was indicated with scales figured by Martins; however, as these were left in open nomenclature little can be added except that both the South American and Western Australian forms are distinct and possibly represent at least one new genus likely to be of palaeoniscid affinity.

Acknowledgements.—I thank the Director of the Geological Survey of Western Australia and the curator of collections, Dr. A. E. Cockbain, for providing material from the collections in their care. Dr. A. E. Cockbain provided information on the stratigraphy and locality of the specimens. Dr. G. A. Thomas, University of Melbourne, critically read the manuscript. The assistance of the staff of the Baillieu Library is gratefully acknowledged and Mrs. G. Waterman typed the manuscript. The work was carried out while I was in receipt of a University of Melbourne Postgraduate Award.

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Figure 1.—Fish scales from GSWA sample 44553. All specimens whitened with ammonium chloride. A.—GSWA F11006 fish scale x 5. B.—GSWA F11007 fish scale x 5. C.—GSWA F11008 fish scale x 5. D.—GSWA F11009 fish scale x 4.5. E.—GSWA F11010 fish scale x 5. F.—GSWA F11011 fish scale x 5. G.—GSWA F11016 portion of block with fish scales x 1. H.—GSWA F11012 portion of fish scale x 12. I.—GSWA F11012 fish scale x 5.

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